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ABSTRACT

A random sample of fourth, eighth, and eleventh grade Illinois students has been tested annually since 1976 by the Illinois State Board of Education. This testing program is called the Illinois Inventory of Educational Progress (IIEP). This report presents mathematics achievement results of a random sample of fourth (N=6,103), eighth (N=10,026), and eleventh grade (N=16,264) students tested in 1982, factor analysis results, and teacher survey information. The 1982 testing focused on students' knowledge of mathematical measurement. As such, a three-factor model was developed that provides for three types of measurement units (nonstandard, metric, and conventional), five categories of measurement skills (estimation, conversions within, comparisons between, selecting and/or reading instruments, and problem-solving), and five types of measurement attributes (length, area, capacity, mass, and temperature). Major findings are presented in separate chapters for each grade level. Two conclusions emerge from these results: (1) students perform at roughly the same level in all aspects of mathematical measurement tested by the IIEP and (2) students are weak in measurement. In addition, students have considerably less problems with the metric system than many people think. (Copies of test instruments, correct answer keys, a sample teacher survey instrument, and other information are included in appendices.) (JN)

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Summary of the 1982 MATHEMATICS RESULTS OF THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS

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Illinois State Board of Education

Summary of the
1982 MATHEMATICS RESULTS
OF THE
ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS

FOREWORD

What follows is an overview of the 1982 Illinois Inventory of Educational Progress (IIEP) in mathematical measurement. The tests have been administered by the Illinois State Board of Education since 1976; however, this analytical report is in a new and more usable format.

Development of the IIEP is discussed, and results and analyses of the tests administered to fourth, eighth, and eleventh grade students are presented. It is hoped that the information contained here will enhance instruction in Illinois schools.

While many Illinois educators contributed to the preparation of this report, I would like to especially acknowledge the efforts of Dr. John A. Dossey, Illinois State University, and Dr. Mervin M. Brennan, Illinois State Board of Education, as the main writers. Any questions concerning this report may be addressed to Dr. Brennan or Dr. Thomas Kerins, Manager of the Program Evaluation and Assessment Section, Department of Planning, Research and Evaluation, Illinois State Board of Education.

Donald G. Gill
State Superintendent of Education

PREFACE

Purpose

The Illinois Inventory of Educational Progress (IIEP) is a systematic effort by the Illinois State Board of Education to collect information on the educational achievement of Illinois students in specific academic subjects and make that information available to educational decision makers.

The three goals of the IIEP are:

1) to make available relevant, reliable, and valid data on the educational achievement of Illinois students;

2) to chart trends (growth, stability, or decline) in educational achievements over time; and

3) to publish results of research conducted in connection with the IIEP.

Student Selection

A random sample with two sampling stages is used to select those students attending Illinois public schools who will participate.

First, schools throughout the state are chosen randomly. Samples of 2,400 fourth, eighth, and eleventh graders are then randomly selected from lists of eligible students submitted by the schools. These grade levels correspond roughly with the end of primary, elementary, and secondary education. (See Chapter 1 for the special, larger samples used in the 1982 IIEP.)

The IIEP is designed to measure group rather than individual, achievement; no individual student, teacher, school, or district is identified in reports.

Type of Test

The IIEP is an objective-referenced test. Desired student performance is expressed in terms of objectives, for example: "Fourth grade students should be able to recognize geometric shapes such as circles, etc." Student performance is measured by test items designed to determine whether or not certain groups of students are able to do what the objectives state they should be able to do.

Subject Areas

The IIEP has been in existence since 1976. A number of subject areas have been assessed, including, reading, writing, mathematics, science, citizenship, energy and nutrition, as well as student attitudes about themselves and education in general.

Base-line data are collected during the first year an academic subject is assessed. In each succeeding year that a subject area is reassessed, comparisons are made between earlier and later student performance, and any growth or decline in achievement is noted.

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OVERVIEW

SUMMARY OF ILLINOIS STUDENT ACHIEVEMENT IN MATHEMATICS

In February, 1983, the Illinois State Board of Education published a report entitled Student Achievement in Illinois: An Analysis of Student Progress. The report describes and synthesizes the results of six different measures of the achievement of Illinois students from 1970-1981; these six tests include the Illinois Inventory of Educational Progress (IIEP), Decade Study test (DST), High School and Beyond test (HSB), Scholastic Aptitude Test (SAT), American College Test (ACT), and The National Assessment of Educational Progress (NAEP). The above-mentioned report describes these instruments in terms of students tested, curricular areas assessed, and overall purpose. It summarizes student progress across years, from basic to advanced skills in reading, language arts, social studies, mathematics and science. Here are some of the findings of that report regarding the mathematics achievement of Illinois students.

- Illinois students of 1981 showed significantly higher mathematics achievement than 1976 students in elementary school mathematics.
- Illinois students of 1981 showed significantly lower mathematics achievement than 1970 students in high school mathematics.
- Mathematics achievement of Illinois high school sophomores was significantly higher than the achievement of sophomores in the South, and statistically equivalent to sophomores in the rest of the United States on the High School and Beyond Study test.
- Mathematics achievement of Illinois high school seniors on the High School and Beyond test was significantly higher than the achievement of seniors in the South, but significantly lower than the achievement of New York seniors. Illinois scores were statistically equivalent to scores of all other groups of seniors across the United States.

Results of Correlational Analysis

- Students who took advanced courses in mathematics tended to achieve higher scores than those who did not.
- Students whose parents showed an active interest in their academic achievement achieved higher scores than those whose parents showed little interest.

- Students who reported low levels of test anxiety tended to achieve higher scores than students who said tests made them quite anxious.

- Males scored significantly higher than females on the high school mathematics tests of the IIEP, ACT, and SAT, but scores for males and females were statistically equivalent on the mathematics subtests of the Decade Study.

- Parental education level was significantly related to student achievement in mathematics.

Copies of "Student Achievement in Illinois: An Analysis of Student Progress" can be obtained from the Program Evaluation and Assessment Section, Illinois State Board of Education.

Summary of the Present Report

A random sample of fourth, eighth, and eleventh grade Illinois students has been tested annually since 1976 by the Illinois State Board of Education. This testing program is called the Illinois Inventory of Educational Progress (IIEP). This report presents student achievement results, factor analysis results,[1] and teacher survey information.

A three-factor model[2] was developed for mathematical measurement. The model provides for three types of measurement units (nonstandard, metric, and conventional), five categories of measurement skills (estimation, conversions within, comparisons between, selecting and/or reading instruments, and problem solving), and five types of measurement (length, area, capacity, mass, and temperature).

The analysis of the data showed that there is only one measurement factor at each of the three grade levels tested. Further analysis showed that the three hypothesized factors of the measurement model have no significant between- or within-factor differences for student performance at any of those levels. No tests were carried out for interactions of the three hypothesized factors of the measurement model due to the nonproportional assignment of items to the cells of the model and the large number of blank cells.

[1]A description of factor analysis is contained in Appendix D.

[2]The three-factor model was developed by Lynn Brown (Illinois State University), Dale Jungst (Northern Illinois University), and Kenneth Retzer (Illinois State University). The model is described in detail in the paper "A Three Factor Model of Mathematical Measurement," which is available upon request.

CHAPTER 1

The Illinois Inventory of Educational Progress - Mathematical Measurement

Development of the 1982 Mathematics IIEP

The 1982 IIEP was designed to collect information concerning student knowledge of mathematical measurement at grades 4, 8, and 11. As such, a three-factor model for mathematical measurement was developed (see Figure 1). The model provides for three types of measurement units (nonstandard, metric, and conventional), five categories of measurement skills (estimation, conversions within, comparisons between, selecting and/or reading instruments, and problem solving), and five types of measurement attributes (length, area, capacity, mass, and temperature). The nature of the above factor levels is clarified by the information in Table 1.

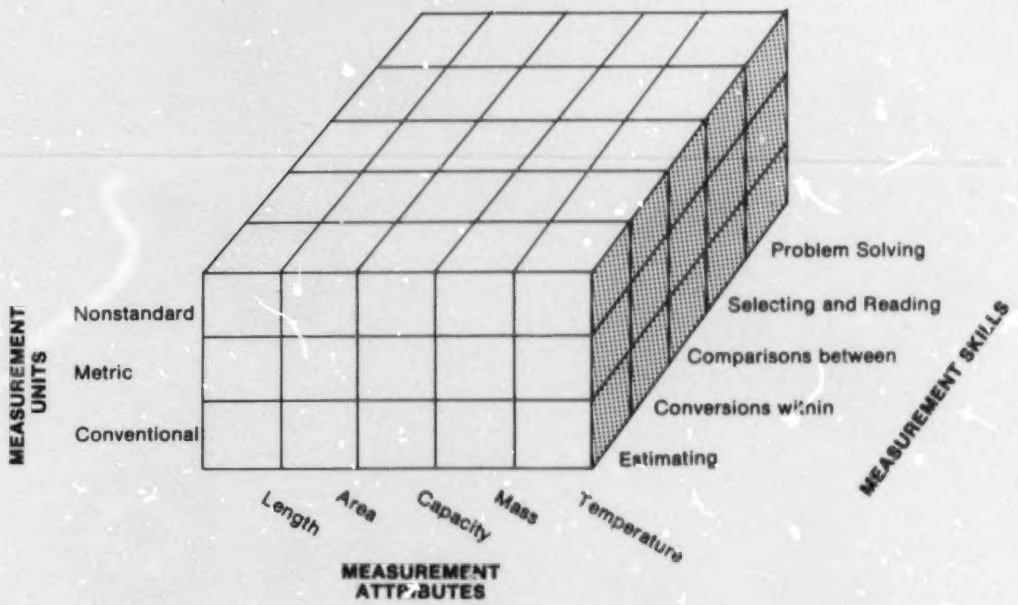


Figure 1: The Measurement Model

TABLE 1

DESCRIPTION OF MODEL FACTORS AND LEVELS

1. Measurement Units: The three types of measurement units (systems) used in the construction of the IIEP were:

   a) Nonstandard units---a system of measurement units consisting of defined equivalences of units not usually used for measurement in business or technical applications. Nonstandard units might involve the use of pencil lengths, eraser lengths, etc.
   b) Metric units---the decimal system of weights and measures referred to as The International System of Units in which the meter, liter, and gram are the basic units of length, capacity, and weight, respectively.
   c) Customary units---the system referred to generally as the United States customary system of weights and measures, in which the yard, gallon, and the avoirdupois pound are the fundamental units for length, capacity, and weight, respectively.

2. Measurement Attributes: The five types of measurement attributes considered in the items selected for the IIEP were:

   a) Length---the assignment of a number to a segment indicating the distance between its endpoints.
   b) Area---the assignment of a number to a bounded region in the plane indicating the number of square units needed to cover the region.
   c) Capacity---the assignment of a number to a bounded three-dimensional region indicating the amount of space occupied by the region, usually in terms of cubic units or fluid measure.
   d) Mass---the quantity of matter in a body as measured by its relation to its inertia; the weight of a body divided by its acceleration due to gravity; common usage refers to mass as weight; the quantity of "heaviness" of a physical object.
   e) Temperature---the degree of hotness or coolness of anything, usually measured on a thermometer, such as the degree of heat in the atmosphere as measured on the Celsius or Fahrenheit scales.

3. Measurement Skills: The five types of measurement skills required to solve the problems were:

   a) Estimation---a judgment of the reasonable questions, information, and answers necessary for dealing with a problem; a calculated approximation of what is reasonable, the range of what is reasonable, and a judgment of things not reasonable.
   b) Conversions Within---knowledge and computations of the conversion of one unit of measurement to another unit in the same system, e.g. 100 cm = 1 m or 12 in. = 1 ft.
   c) Comparisons Between---knowledge and computations for the conversion of one unit in one system to a unit in a different system of measurement, e.g. 1 in. = 2.54 cm or 1 liter = 1.06 quarts.
   d) Selecting/Reading Instruments---the ability to select the appropriate measurement device and/or determine the correct type of unit and measure the number by the correct usage of the device.

e) Problem Solving---the ability to determine the information necessary to answer the problem of concern, to gather it, apply it, and arrive at the correct solution.

Sample

The tests were administered in the spring of 1982 to the randomly drawn sample of 6,103 fourth graders, 10,026 eighth graders, and 16,264 eleventh graders. These samples were larger than the samples (2,400 per grade level) used other years for the IIEP at the request of a number of schools. The results from their responses on the IIEP measurement items provide the data base for the presentations in the remainder of this document.

Teacher Sample

In addition to the student information, one teacher at each school was selected by the building principal to answer a form (see Appendix B) which requested information on the appropriateness of the items for students in that school. In particular, the teacher had to answer the following four questions.

1) On a scale from 1 to 9 (1-No Student Exposure; 9-Heavy Student Exposure), TO WHAT EXTENT HAVE STUDENTS BEEN EXPOSED TO THE ITEM CONTENT?

2) On a scale from 1 to 9 (1-Not at All; 9-Very Well), HOW WELL DOES THE ITEM MEASURE THE CONTENT BEING TAUGHT IN THE 4th (8th or 11th) GRADE?

3) On a scale from 1 to 9 (1-Very Easy; 9-Very Difficult), INDICATE THE DIFFICULTY OF THE ITEM.

4) WHAT PERCENTAGE OF STUDENTS WILL ANSWER THIS ITEM CORRECTLY?

The results of these teacher assessments of the items serve as a measure of the validity of the items and as an aid to the interpretation of the student answer patterns. Teacher responses to items 1 through 3 were analyzed via an analysis of the distribution of teacher responses. Teacher responses for each question were divided into three regions: those 0.67 standard deviations below the mean of teacher responses for a question, those in the band + 0.67 standard deviations around the mean, and those above 0.67 standard deviations above the mean. The responses in the former group were termed low and those in the latter group were called high. The 0.67 standard deviation mark approximates the quartiles divisions above and below the mean.

Teacher responses to item 4 concerning teacher expectations of student performance were analyzed in a manner consistent with past IIEP mathematics assessments. The analysis of the discrepancies between the teacher expectations and actual student performance was considered on an item by item basis using the following system of classification:

- o Appropriate (for discrepancies of ten or less percentage points between teacher expectations and actual student performance),
- o Higher Than/Lower Than (for discrepancies falling in the range of 10--20 percentage points),
- o Much Higher Than/Much Lower Than (for discrepancies of 20 or more percentage points).

The use of the above item analysis procedures resulted in four forms of information being reported for each item given to the students. These forms of item information which are reported in Appendix B, are:

1) The percentage of students answering the item correctly,

2) The predicted percentage of student performance given by the teachers,

3) The average level of student exposure to the item as reported by the teachers,

4) The average difficulty level of the item as reported by the teachers.

TABLE OF SPECIFICATIONS: IIEP 1982 MATHEMATICAL MEASUREMENT

GRADE 4

	ESTIMATION	COMPARISONS WITHIN	COMPARISONS BETWEEN	SELECTION/READING INSTRUMENTS	PROBLEM SOLVING	ROW SUMS
LENGTH	1 (3) (M) 24 (C) 18 (NS) 31	2 (2) (M) 32 (C) 26 (NS)	3 (2) (M) (C) (NS) 19, 20	4 (4) (M) 22 (C) 36 (NS) 28, 35	5 (4) (M) 23, 27 (C) 30, 34 (NS)	(15) (M) 5 (C) 5 (NS) 5
AREA	6 (1) (M) 46 (C) (NS)	7 (—) (M) (C) (NS)	8 (2) (M) (C) (NS) 47,48	9 (5) (M) 50, 51 (C) 49, 53 (NS) 52	10 (—) (M) (C) (NS)	(8) (M) 3 (C) 2 (NS) 3
CAPACITY	11 (—) (M) (C) (NS)	12 (1) (M) (C) 38 (NS)	13 (1) (M) 39 (C) (NS)	14 (4) (M) 43, 61 (C) 40 (NS) 45	15 (2) (M) 44 (C) 42 (NS)	(8) (M) 4 (C) 3 (NS) 1
MASS	16 (—) (M) (C) (NS)	17 (1) (M) (C) (NS) 54	18 (1) (M) 55 (C) 55 (NS)	19 (4) (M) 60 (C) 56, 59 (NS) 58	20 (1) (M) 57 (C) (NS)	(7) (M) 2 (1) (C) 2 (1) (NS) 2
TEMPERATURE	21 (—) (M) (C) (NS)	22 (—) (M) (C) (NS)	23 (—) (M) (C) (NS)	24 (—) (M) (C) (NS)	25 (—) (M) (C) (NS)	(—) (M) 0 (C) 0 (NS) 0
COLUMN SUMS	(4) (M) 2 (C) 1 (NS) 1	(4) (M) 1 (C) 2 (NS) 1	(6) (M) 1 (1) (C) (1) (NS) 4	(17) (M) 6 (C) 6 (NS) 5	(7) (M) 4 (C) 3 (NS) 0	(38) (M) 14 (1) (C) 12 (1) (NS) 11

TABLE OF SPECIFICATIONS: IIEP 1982 MATHEMATICAL MEASUREMENT

GRADE 8

	ESTIMATION	COMPARISONS WITHIN	COMPARISONS BETWEEN	SELECTION/READING INSTRUMENTS	PROBLEM SOLVING	ROW SUMS
LENGTH	1 (4) (M) 22 (C) 18 (NS) 19, 35	2 (4) (M) 23, 27, 76 (C) 24 (NS)	3 (3) (M) 28, 32 (C) 28, 30 (NS)	4 (3) (M) 38, 40 (C) 34 (NS)	5 (3) (M) 46 (C) 43, 67 (NS)	(17) (M) 8 (1) (C) 6 (1) (NS) 2
AREA	6 (2) (M) 20 (C) 65 (NS)	7 (1) (M) 26 (C) (NS)	8 (1) (M) 31 (C) (NS)	9 (3) (M) 36 (C) 39 (NS) 42	10 (3) (M) 44, 71 (C) 70 (NS)	(10) (M) 6 (C) 3 (NS) 1
CAPACITY	11 (—) (M) (C) (NS)	12 (1) (M) 47 (C) (NS)	13 (2) (M) 49, 69 (C) 69 (NS)	14 (4) (M) 74 (C) 51 (NS) 53, 55	15 (2) (M) 57, 59 (C) (NS)	(9) (M) 5 (1) (C) 1 (1) (NS) 2
MASS	16 (—) (M) (C) (NS)	17 (2) (M) 48, 66 (C) (NS)	18 (2) (M) 50 (C) 68 (NS)	19 (4) (M) 52, 56, 75 (C) 54 (NS)	20 (3) (M) 58, 72 (C) 60 (NS)	(11) (M) 8 (C) 3 (NS) 0
TEMPERATURE	21 (—) (M) (C) (NS)	22 (—) (M) (C) (NS)	23 (—) (M) (C) (NS)	24 (5) (M) 63 (C) 61, 62, 73 (NS) 64	25 (—) (M) (C) (NS)	(5) (M) 1 (C) 3 (NS) 1
COLUMN SUMS	(6) (M) 2 (C) 2 (NS) 2	(8) (M) 7 (C) 1 (NS) 0	(8) (M) 4 (2) (C) 2 (2) (NS) 0	(19) (M) 8 (C) 7 (NS) 4	(11) (M) 7 (C) 4 (NS) 0	(52) (M) 28 (2) (C) 16 (2) (NS) 6

15

TABLE OF SPECIFICATIONS: IIEP 1982 MATHEMATICAL MEASUREMENT — GRADE 11

	ESTIMATION	COMPARISONS WITHIN	COMPARISONS BETWEEN	SELECTION/READING INSTRUMENTS	PROBLEM SOLVING	ROW SUMS
LENGTH	1 (3) (M) 18, 34, 38 (C) (NS)	2 (3) (M) 20, 32, 61 (C) (NS)	3 (4) (M) 24, 26, 31, 66 (C) 26, 66 (NS)	4 (3) (M) 30, 39 (C) 28 (NS)	5 (3) (M) 42 (C) 22, 36 (NS)	(16) (M) 11 (2) (C) 3 (2) (NS) 0
AREA	6 (2) (M) 19, 69 (C) (NS)	7 (—) (M) (C) (NS)	8 (—) (M) (C) (NS)	9 (2) (M) 41 (C) (NS) 35	10 (3) (M) 27 (C) 23, 27 (NS) 43	(7) (M) 3 (1) (C) 1 (1) (NS) 2
CAPACITY	11 (2) (M) 47, 49 (C) (NS)	12 (2) (M) 45, 55 (C) (NS)	13 (—) (M) (C) (NS)	14 (2) (M) 67 (C) 51 (NS)	15 (2) (M) 53, 57 (C) (NS)	(8) (M) 7 (C) 1 (NS) 0
MASS	16 (—) (M) (C) (NS)	17 (1) (M) (C) 46 (NS)	18 (2) (M) 64 (C) 48, 64 (NS)	19 (4) (M) 50, 52, 56, 68 (C) (NS)	20 (2) (M) (C) 54, 58 (NS)	(9) (M) 4 (1) (C) 4 (1) (NS) 0
TEMPERATURE	21 (—) (M) (C) (NS)	22 (—) (M) (C) (NS)	23 (—) (M) (C) (NS)	24 (4) (M) 60, 65 (C) (NS) 59, 62	25 (1) (M) 63 (C) (NS)	(5) (M) 3 (C) 0 (NS) 2
COLUMN SUMS	(7) (M) 7 (C) 0 (NS) 0	(6) (M) 5 (C) 1 (NS) 0	(6) (M) 2 (3) (C) 1 (3) (NS) 0	(15) (M) 10 (C) 2 (NS) 3	(11) (M) 4 (1) (C) 5 (1) (NS) 1	(45) (M) 28 (4) (C) 9 (4) (NS) 4

The combination of these levels of the three factors gave rise to the 75 cells indicated by the model. This model was then used to develop tests at each of the three grade levels and to gather data about student knowledge of mathematical measurement. Items were selected, or developed, to fill as many of the cells as possible at each of the grade levels, while keeping the tests in as close a match with the grade-level curriculum as possible.

Three tests emerged from a period of field testing and revision that took place in the spring of 1981 and the early fall of 1982. Copies of the final tests are found in Appendix A. The distribution of items on the tests to the cells of the model is shown in Tables 2, 3, and 4 on the following pages. The listing of some items as "comparisons between" under both metric and conventional indicates that the items tested comparisons between metric and conventional measures.

CHAPTER 2

Fourth Grade Results

Major Findings

The analysis of the data at the fourth grade level on the three major factors of the model resulted in no statistically significant differences. Student performance on metric items was not judged to be different from student performance on conventional or nonstandard items. In a like manner, performance on the items for the five different measurement abilities did not reach statistical significance. Likewise, the fourth grade student responses showed no statistically significant patterns among student abilities to deal with the items concerning length, area, capacity, or mass.

A factor analysis was carried out to determine the clustering of items on the basis of like student performances in various areas of the test. The analysis identified one factor of significance. The items having loadings on this factor of a magnitude 0.45 or greater were, in order of descending magnitude: 47, 57, 59, 30, 39, 59, 31, 48, 54, and 58. An analysis of the origins of these items in the model suggested that this factor might be best conceptualized as a general measurement factor. None of the levels of any of the factors of the measurement model dominated the structure of these items. No other factor identified in the factor analysis had an eigenvalue greater than one.

In regard to "extent of student exposure," the teachers' mean rating was 4.2025 on a scale from 1(low) to 9(high). This indicated a teacher feeling that the students had had somewhat less than average exposure to the topics on the test. Using the same rating scale, the teachers responded that the items sampled the measurement curriculum in their classes at an average level; their mean rating was 5.0855. This response provides a measure of the validity of the items as they are compared to the fourth grade curriculum. Some items were judged to have a low content validity. These items are discussed in the report Curricular Analysis of the 1982 Mathematics Results of the Illinois Inventory of Educational Progress, which is available from the Illinois State Board of Education.

When asked to judge the difficulty level of the test, the teachers gave the test a mean rating of 5.4281 on a scale of 1(easy) to 9(hard). This indicates that the test was slightly harder than average. Student performance showed that the teachers are probably fairly accurate in their judgments. The analysis of the relationship between the student performance and the teacher predictions of student performance was carried out for the test item-by-item. The correlation coefficient for the relationship was 0.72. This value is statistically significant at the 0.01 level. The overall mean student performance on the test was 45.52%, while the teacher prediction was 47.12%.

The fourth grade test is displayed in Appendix A. The student and teacher data for each item are in Appendix B and can be matched to the items in Appendix A.

CHAPTER 3

Eighth Grade Results

Major Findings

The analysis of the data resulting from the student responses at the eighth grade indicated that the three factors have no significant differences among student performance at any of their levels. This finding indicates that student performance was as good on metric items as it was on conventional items from a statistical standpoint. In a like manner, the five different measurement abilities did not have any significant differences in terms of student performance on items measuring their use. Students also showed no significant differences in their ability to deal with length, area, capacity, mass, or temperature.

No tests were carried out for interactions of the three factors of the measurement model due to the nonproportional assignment of items to the cells of the model and the large number of blank cells.

A factor analysis was carried out to determine the clustering of items on the basis of like student performances on those items. The factor analysis identified a single factor. The items having loadings on this factor of absolute value 0.5 or greater were numbers 74, 72, 75, 71, 23, 67, 62, 55, 42, 40, and 36. An analysis of the items suggested that the factor might be representing the ability to select/read instruments. Items from both areas were represented in the item set, so no finer analysis was made. No other factors had eigenvalues greater than one.

Teacher ratings of items in regard to extent of student exposure showed a mean rating of 5.3331 on a scale of 1 to 9. This was an average rating. Using the same rating scale, the teachers' rating for how well the items measured content covered in the classroom was 5.5615. This response provides some measure of validity of the test items. Several items were judged as having low content validity when measured against the curriculum. These items are discussed in the report Curricular Analysis of the 1982 Mathematics Results of the Illinois Inventory of Educational Progress, which is available from the Illinois State Board of Education. When asked to judge the difficulty of the items, the teachers gave the test a mean rating of 4.6395 on a 1-easy to 9-difficult scale. This indicates that they felt the items were slightly easier than average. Student performance showed that the eighth grade teachers were perhaps a bit optimistic. The teachers' prediction was 56.50%; student average performance was 46.93%. The analysis of the relationship between the student performance and teacher predictions of student performance was carried out for individual items and for the item set as a whole. The correlation coefficient for the entire data set was 0.6082.

The eighth grade test is displayed in Appendix A. The student and teacher data for each item are in Appendix B and can be matched to the items in Appendix A.

CHAPTER 4

Eleventh Grade Results

Major Findings

The analysis of the data resulting from the student responses at the eleventh grade suggested that the three factors have no significant differences in student performance at any of their levels. This finding indicates that student performance on metric items was equivalent to that on conventional items from a statistical standpoint. In a like manner, the five different measurement abilities did not result in any significant differences in terms of student performance on items measuring their use. Likewise, students showed no significant difference in their ability to deal with length, area, capacity, mass, or temperature.

No tests were carried out for interactions of the three factors of the measurement model due to the nonproportional assignment of items to the cells of the model and the large number of blank cells.

A factor analysis was carried out to determine the clustering of items on the basis of like student performance on these items. The analysis showed one factor of significance. The items having loadings on this factor of magnitude 0.50 or greater were, in descending order 33, 66, 37, 55, 63, 65, 26, 28, 22, 48, 21, 53, 59, 38, 45, and 46. An analysis of the origins of these items in the model suggested that this factor might be best conceptualized as a general measurement factor. None of the levels of any of the factors of the measurement model dominated the structure of these items. No other factor identified in the factor analysis had an eigenvalue greater than one.

A comparison of teacher predictions for student performance on the test items and the students' actual performances were correlated at the 0.6307 level. When teachers were asked to rate the items on the extent students had been exposed to the items using a scale that ranged from 1 (none) to 9 (heavy), their mean rating was 5.4976. This indicates that the item bank as a whole had had average coverage in the classroom for eleventh graders at the given grade or earlier. Under the same measurement scale, the teachers indicated that the items fell somewhat short of covering the full spectrum of measurement activities eleventh graders had been exposed to by the third year of secondary school. In response to "how well the items measured the content taught by them," the teachers' mean rating was 3.3246. This finding is somewhat expected, especially in taking into account the more specialized backgrounds of some eleventh grade students in the areas of science and mathematics. This is also partially an artifact of trying to keep the items used somewhat comparable for 4th, 8th, and 11th grade students. The teachers also gave the item set an overall difficulty rating of 3.4118, indicating they felt it fell more toward the easy end of the difficulty

spectrum. However, final results showed that eleventh grade teachers slightly overpredicted their students' performance. The teachers' prediction was 58.04% correct, but the students only achieved at the level of 52.05%.

Detailed analysis of the results is contained in the report Curricular Analysis of the 1982 Mathematics Results of the Illinois Inventory of Educational Progress, which is available from the Illinois State Board of Education. In that report the student response patterns are discussed for each item.

The eleventh grade test is displayed in Appendix A. The student and teacher data for each item are in Appendix B and can be matched to the items in Appendix A.

CHAPTER 5

Summary Discussion

Chapters 2, 3, and 4 presented the statistical findings from the 1982 IIEP tests and teacher questionnaires. The actual tests are shown in Appendix A followed by the student and teacher data in Appendix B.

Two conclusions emerge from the results of the 1982 data. First, students perform at roughly the same level in all the aspects of mathematical measurement which were tested by the IIEP. Student average scores were substantially equivalent for test items about length, area, capacity, mass, and temperature. Students did equally well in estimations, conversions within a system, comparisons between systems, selection and/or reading of measurement instruments, and problem solving. Furthermore, students did as well on metric problems and non-standard units as they did on customary U.S. units. Apparently, students have considerably less problems with the metric system than many people think.

The second conclusion is that students are weak in measurement. Student scores are lower in measurement than in every other aspect of mathematics except geometry. Table 5 shows comparisons for seven years of IIEP data.

Table 5
Summary Performance of Fourth, Eighth, and Eleventh Grade Illinois Students on the Illinois Inventory of Educational Progress over Seven Years of Tests*

	Percentages Correct		
	Grade 4	Grade 8	Grade 11
Whole Numbers	75%	67%	86%
Mathematical Concepts	64%	60%	67%
Fractions	**	68%	63%
Algebra	**	57%	61%
Application	60%	54%	59%
Measurement (1982)	46%	47%	52%
Geometry	35%	48%	47%

* Individual items were averaged, then a grand mean computed
** indicates insufficient data

A detailed discussion of the 1982 IIEP results is contained in the curricular report mentioned in Chapters 2-4. The curricular report goes over the results for each test item, displays the percentages of students which selected each answer choice (incorrect as well as correct), discusses what mistakes students made, and why the mistakes were made.

A final note should be added. Although the fourth grade measurement score was 18 points below that year's arithmetic score, the eighth grade score in measurement was only 13 points lower, and the eleventh grade score was only 3 percentage points below its score in arithmetic. Measurement ability improves with years of schooling.

APPENDIX A

THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS

1982 GRADE 4

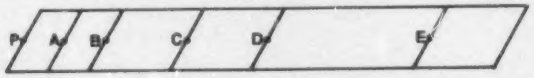
MATHEMATICAL MEASUREMENT TEST

DO NOT BEGIN UNTIL TOLD TO DO SO

Directions (to be read aloud by the test administrator)

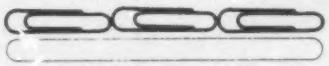
You will have 45 minutes to complete the mathematics test which begins with question 18 and ends with question 61. Work at a reasonably fast pace. You should be able to complete all the test questions. If you have extra time, go back and check your work. If you finish before the test administrator tells you to stop, go on and complete questions 62-79. You will have to do all the work yourself. Your test administrator will not be able to help you. READY, BEGIN.

18. John wants to cut a 3 inch board for his model airplane from the board below. If he measures from end P, at which mark will he cut the board?



A) Mark A
B) Mark B
C) Mark C
D) Mark D
E) Mark E

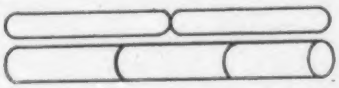
19. One popsicle stick is the same length as three paper clips.



Which is the longest?

A) 14 paper clips
B) 5 popsicle sticks
C) 3 popsicle sticks, 4 paper clips
D) 2 popsicle sticks, 8 paper clips
E) 1 popsicle stick, 10 paper clips

20. 3 pieces of chalk are the same length as 2 popsicle sticks.



How many popsicle sticks would be the same length as 12 pieces of chalk?

A) 8
B) 9
C) 11
D) 12

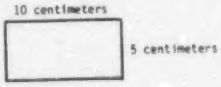
21. Find the difference:
$$\begin{array}{r} 2043 \\ -\ 317 \end{array}$$

A) 1,735
B) 1,627
C) 1,726
D) 1,636

22. In the metric system, the basic unit of length is the

A) meter.
B) liter.
C) gram.
D) kilogram.
E) degree.

23. What is the PERIMETER of this rectangle?



A) 10 centimeters
B) 15 centimeters
C) 20 centimeters
D) 25 centimeters
E) 30 centimeters

24. Which of the following is the most sensible measure for the height of a table?

A) 1 millimeter
B) 1 kilometer
C) 1 centimeter
D) 1 meter
E) 1 decimeter

25. What digit is in the tens place in 4,263?

A) 2
B) 3
C) 4
D) 6

26. One yard is equal to ___?___ inch(es)?

A) 1
B) 10
C) 12
D) 36
E) 100

27) John has three pieces of string.
The brown piece is 150 centimeters long.
The green piece is 15 meters long.
The red piece is 1.5 meters long.

Which string is the longest?

A) The brown string
B) The green string
C) The red string
D) All 3 pieces are the same length.

28. Which of the following would be the best for measuring the length of a room?

A) A coffee cup
B) A pencil
C) A basketball
D) A rubber band
E) A tea pot

29. What is the next larger odd number after 5?

A) 6
B) 7
C) 8
D) 9

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30. The scale below the map shows that 1 inch on the map equals 5 miles actual distance. The distance between Frogville and Toadville is about 3 inches on the map.

What is the actual distance between Frogville and Toadville?

A) 5 miles
B) 5 miles and 1 inch
C) 15 miles
D) 15 miles and 3 inches
E) 20 miles

31. How many zogs is the length of line segment AB?

A) 1 zog
B) 2 zogs
C) 6 zogs
D) 13 zogs
E) 32 zogs

32. One meter is equal to

A) 10 centimeters.
B) 50 centimeters.
C) 100 centimeters.
D) 500 centimeters.
E) 1000 centimeters.

33. Four and two-fifths is written as

A) $\frac{42}{5}$

B) $\frac{4}{25}$

C) $4\frac{2}{5}$

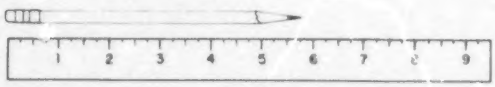
D) None of these

34. Sally has three ribbons.
The red ribbon is 56 inches long.
The blue ribbon is 5 feet long.
The green ribbon is 2 yards long.

Which ribbon is the longest?

A) The red ribbon
B) The blue ribbon
C) The green ribbon
D) All three ribbons are the same length.

35. Which best describes the length of the pencil?



A) Between 0 and 1 units, nearer 0 unit
B) Between 0 and 1 units, nearer 1 unit
C) Between 3 and 8 units, nearer 8 units
D) Between 5 and 6 units, nearer 5 units
E) Between 5 and 6 units, nearer 6 units

36. What is the length of the fish?

A) $2\frac{3}{4}$ inches
B) 3 inches
C) $3\frac{1}{4}$ inches
D) $3\frac{1}{2}$ inches
E) $4\frac{1}{4}$ inches

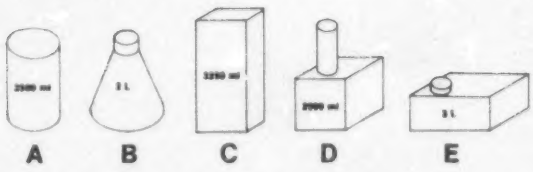
37. A sports car owner says that the car gets 22 miles per gallon of gasoline. How many miles could the car go on seven gallons of gasoline?

A) 144 miles
B) 154 miles
C) 164 miles
D) 174 miles

38. One gallon fills 4 quarts. One quart fills 2 pints. How many pints will one gallon fill?

A) 2
B) 4
C) 6
D) 8
E) 12

39. Which container is the smallest?



40. Which of the following is usually measured in quarts?

A) Oil for the car
B) Perfume
C) Gasoline for the car
D) Heating oil for the home
E) Gardens

41. Mary earned $1.00 raking leaves. Candy bars cost 15 cents. How many candy bars can she buy with her money?

A) 3
B) 4
C) 6
D) 7

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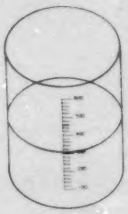
42. An astronaut is to orbit the earth in a space capsule for seven days. If he drinks three pints of water each day, how many pints of drinking water will be needed for the trip?

A) $2\frac{1}{3}$
B) 7
C) 10
D) 21
E) 28

43. The amount of liquid in the cylinder is



A) 100 milliliters.
B) 150 milliliters.
C) 200 milliliters.
D) 250 milliliters.
E) 300 milliliters.

44. Jane is making a drink that contains

250 milliliters of orange juice
150 milliliters of lemon juice
750 milliliters of water

A container holding ? milliliters would be the smallest container which would hold the drink.

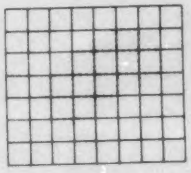
A) 250
B) 500
C) 1,000
D) 1,100
E) 1,150

45. Which of these may be used to measure the amount of water in a bathtub?

A) A penny
B) A paper clip
C) A thermometer
D) A coffee can
E) A postage stamp

46. Let this Box ☐ represent 1 square centimeter. ESTIMATE the area of the SHADED region.

A) 10 square centimeters
B) 15 square centimeters
C) 20 square centimeters
D) 23 square centimeters
E) 25 square centimeters

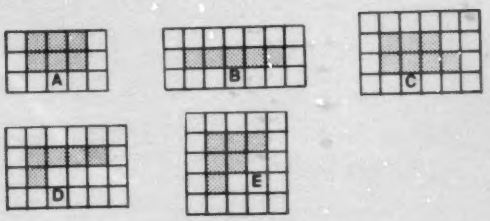


47. The area of one is equal to two

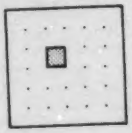
How many will have the same area as 12 ?

A) 3
B) 6
C) 10
D) 12
E) 24

48. Which figure below has the greatest shaded area?



49. The area of the shaded square on the dot paper represents 1 square foot.

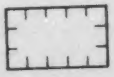


The area of the shaded figure shown below on the dot paper is ? square foot (square feet.)

A) 1 square foot
B) 2 square feet
C) 4 square feet
D) 6 square feet
E) 8 square feet

50. Let ☐ represent 1 square centimeter. The area of the region is ? square centimeters.

A) 8
B) 15
C) 16
D) 30
E) 225



51. A square centimeter is used to measure

A) how long something is.
B) how hot something is.
C) how much something can hold.
D) how heavy something is.
E) how much covering something needs.

52. Which of the following would be best to measure the area of a piece of paper?

A) A postage stamp
B) A coffee cup
C) A needle
D) A clock
E) A pound weight

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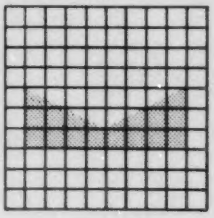
53. Let this box ☐ represent 1 square inch.
The area of the shaded figure is ___ square inches?

A) 8
B) 12
C) 16
D) 20
E) 24



54. The weight of one is equal to three .

How many is equal to the weight of 6 ?

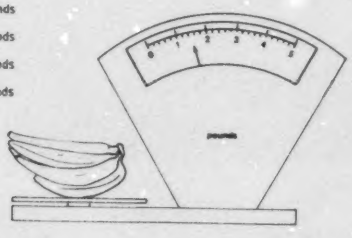
A) 2
B) 3
C) 9
D) 18
E) 28

55. Which is the lightest unit of measure for weight?

A) An ounce
B) A pound
C) A gram
D) A kilogram
E) A ton

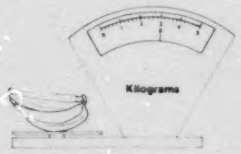
56. How much do the bananas weigh to the nearest $\frac{1}{2}$ pound?

A) $\frac{1}{2}$ pound
B) $1\frac{1}{2}$ pounds
C) 2 pounds
D) $2\frac{1}{2}$ pounds
E) 3 pounds



57. Bananas cost 50 cents per kilogram. How much would these bananas cost?

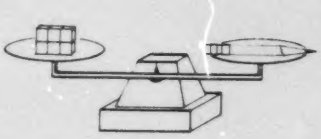
A) $ .44
B) $ .53
C) $1.00
D) $1.50
E) $3.00



58. One weighs one zook.

What is the weight of the pencil?

A) 6 grams
B) 1 pound
C) 6 zooks
D) 2 kilograms
E) 3 zongs



59. How much do the grapes weigh to the nearest $\frac{1}{2}$ pound?

A) $1\frac{1}{2}$ pounds
B) 2 pounds
C) $2\frac{1}{2}$ pounds
D) 3 pounds
E) $3\frac{1}{2}$ pounds

60. A gram is used to measure

A) how long something is.
B) how hot something is.
C) how much something can hold.
D) how heavy something is.
E) how much area is covered.

61. A milliliter is most often used when measuring the capacity of

A) an automobile radiator.
B) a bathtub.
C) the juice in a lemon.
D) a grain silo.
E) a large coffee maker.

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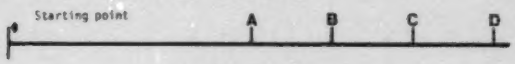
THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS
1982 GRADE 8

MATHEMATICAL MEASUREMENT TEST

Directions (to be read aloud by the test administrator)

You will have 45 minutes to complete the mathematics test which begins with question 18 and ends with question 76. Work at a reasonably fast pace. You should be able to complete all the test questions. If you have extra time go back and check your work. If you finish before the test administrator tells you to stop, go on and complete questions 77-94. READY, BEGIN.

18. An ant crawls 4 inches along the path. If you measure from the starting point, at which mark did it stop?



A) Mark A
B) Mark B
C) Mark C
D) Mark D

19. If you measure by "new pencil lengths", the length of a classroom for 30 students would be about ___?___ new pencil lengths.

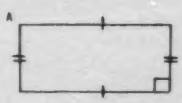
A) 5
B) 10
C) 200
D) 400
E) 2,000

20. This is a square centimeter, .

How many square centimeters would be needed to cover this stamp?

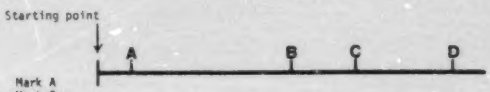
A) 1
B) 2
C) 3
D) 5
E) 6

21. Angle A is what kind of angle?



A) Acute
B) Right
C) Oblique

22. An ant crawls 5 cm along the path. If you measure from the starting point, at which mark did it stop?



A) Mark A
B) Mark B
C) Mark C
D) Mark D

23. 5 meters 34 centimeters is equal to ___?___ centimeters.

A) 39
B) 84
C) 534
D) 534
E) 50034

24. 4 feet is equal to ___?___ inches.

A) 3
B) 12
C) 36
D) 48
E) 54

25. Ruth has savings of $17.25. She wants to buy the following things.

skirt	$9.00
belt	$3.00
book	$2.50
records	$4.98

How much more money does she need before she can buy all of these items? (Do not include sales tax in your answer.)

A) $1.73
B) $2.03
C) $2.13
D) $2.23

26. The area of a card table is 1 square meter. How many square centimeters is this?

A) 0.0001
B) 0.01
C) 100
D) 1,000
E) 10,000

27. 19.3 millimeters is equal to ___?___ decimeters.

A) 0.0193
B) 0.193
C) 1.93
D) 193
E) 1,930

28. Which is the longest?

A) 8 feet
B) 8 inches
C) 8 centimeters
D) 8 meters
E) 8 yards

29. $-2 \times 12 =$

A) 24
B) -24
C) 14
D) 6

30. Which of the following is the shortest length?

A) 75 inches
B) 6 feet 2 inches
C) 5 feet 10 inches
D) 2 yards
E) 1 yard 35 inches

31. Which of the following is the largest area?

A) 0.01 square meter
B) 1 square meter
C) 10 square decimeters
D) 1,000 square centimeters
E) 10,000 square millimeters

32. Which of the following is the shortest length?

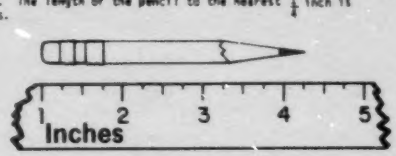
A) 0.01 kilometers
B) 3.4 meters
C) 19 decimeters
D) 35 centimeters
E) 340 millimeters

33. $4^3 =$

A) 12
B) 24
C) 48
D) 64

34. The end of the ruler is broken so the end of the pencil is placed at the one inch mark. The length of the pencil to the nearest $\frac{1}{4}$ inch is ___?___ inches.

A) $2\frac{1}{8}$
B) $2\frac{3}{4}$
C) $3\frac{1}{4}$
D) $3\frac{1}{2}$
E) $4\frac{1}{4}$



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35. How many keys is the length of line segment PQ?

A) 2
B) $2\frac{1}{2}$
C) 3
D) $3\frac{1}{2}$
E) 4

36. What units would usually be most appropriate for measuring the area of the floor of a school gymnasium?

A) square centimeters
B) square decimeters
C) square meters
D) square kilometers
E) square millimeters

37. John's parents bought a refrigerator for $375. If they pay $20 per month for two years, how much more than $375 will the refrigerator cost them?

A) $ 95
B) $105
C) $200
D) $375

38. The key in the picture is about ____?____ centimeters long.

A) 3.5
B) 4
C) 5
D) 6
E) 8

39. An acre is a measure of

A) area.
B) length.
C) volume.
D) width.
E) weight.

40. How long is the pencil to the nearest millimeter?

A) 67 millimeters
B) 65 millimeters
C) 7 millimeters
D) 6.7 millimeters
E) 6 millimeters

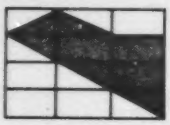
41. Solve the following equation:

$3x - 3 = 12$
$x =$

A) 15
B) 5
C) 3
D) 9

42. Assume this is one unit of area. What is the area of the shaded figure?

A) 8 units
B) 11 units
C) 12 units
D) 13 units
E) 24 units



43. How many 10-inch pieces can be cut from a metal bar 2.13 yards long?

A) None
B) 2
C) 4
D) 7
E) 21

44. Fred Flintstone wants to carpet the family room. If the room measures 5 meters by 6 meters, how many square meters of carpeting will be needed?

A) 11
B) 22
C) 30
D) 36
E) 121

45. $-7 \div -3 =$

A) -9
B) 3
C) +9
D) -3

46. In order to conserve energy one can put weather strips around windows to prevent heat loss. If you have a 70 centimeters by 90 centimeters window, how long a piece of weather stripping must you purchase to go around that window?

A) 20 centimeters
B) 160 centimeters
C) 230 centimeters
D) 320 centimeters
E) 6300 centimeters

47. 0.25 liters is equal to ____?____ milliliters.

A) 0.00025
B) 0.075
C) 2.5
D) 25
E) 250

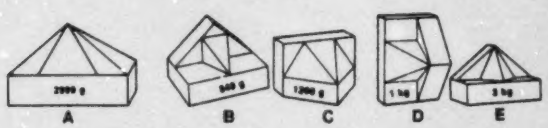
48. 483 milligrams is equal to ____?____ grams?

A) 0.483 grams
B) 4.83 grams
C) 48.3 grams
D) 483 grams
E) 4830 grams

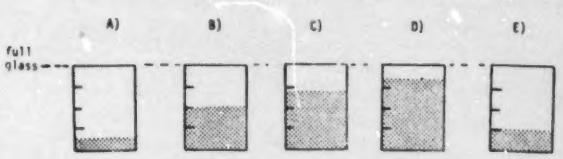
49. Which of the following is the largest?

A) 5.6 liters
B) 48 deciliters, 16 centiliters
C) 478 centiliters, 29 milliliters
D) 549 centiliters
E) 4,389 milliliters

50. Which is the lightest object?



51. A glass of milk is 8 ounces. Which drawing shows 2 ounces?



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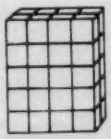
52. Which unit would be most appropriate to measure the weight of a watermelon?

A) A gram
B) A milligram
C) A kilogram
D) A liter
E) A meter

53. This is a cubic unit . Choose the numeral that tells how many cubic units are needed to build the figure.

A) 11
B) 38
C) 40
D) 58
E) 80



54. How much does the letter weigh to the nearest 1/4 ounce?

A) $\frac{1}{4}$ ounce
B) $\frac{3}{4}$ ounce
C) $1\frac{1}{2}$ ounces
D) $1\frac{3}{4}$ ounces
E) $2\frac{1}{2}$ ounces

55. How much water is in this glass?

A) 403
B) 406
C) 430
D) 460
E) 480

56. How many kilograms do the grapes weigh?

A) 2,500
B) 250
C) 25
D) 2.5
E) 0.25

57. A box that is 1 centimeter long, 1 centimeter wide and 1 centimeter high will hold

A) 1 liter.
B) more than 1 liter.
C) 1 milliliter.
D) less than 1 milliliter.

58. Ricardo ate an orange weighing 0.182 kilograms and a banana weighing 0.15 kilograms. How many kilograms of fruit did he eat?

A) 0.032
B) 0.197
C) 0.232
D) 0.332
E) 3.32

59. How many liters of water are needed to fill a fish tank which is 3 decimeters wide, 8 decimeters high and 5 decimeters long?

A) 16
B) 55
C) 64
D) 120
E) 240

60. A 50-pound bag of fertilizer is labeled 15-40-5. This means that of the ingredients in the bag 15% is nitrogen, 40% is phosphate, and 5% is potash. How many pounds of nitrogen are in the bag?

A) 0.75
B) 2.5
C) 7.5
D) 15
E) 20

61. What is the temperature shown on this cooking thermometer?

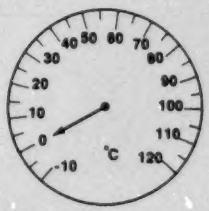
A) 200°
B) 90°
C) 80°
D) 70°
E) 30°

62. Which of the Fahrenheit temperatures is nearest the freezing point of water?

A) 20°F
B) 35°F
C) 42°F
D) 60°F
E) 80°F

63. The temperature shown is:

A) the freezing point of water.
B) the boiling point of water.
C) the normal human body temperature.
D) a warm summer day.
E) a comfortable room temperature.



64. Which would be an appropriate instrument to measure the temperature of the air out of doors?

A) A barometer
B) A protractor
C) A hydrometer
D) An ammeter
E) A thermometer

65. The approximate area of this sheet of paper is ___?___ square inches.

A) 20
B) 40
C) 90
D) 600
E) 1,000

66. 0.025 kilograms is equal to ___?___ decigrams.

A) 0.0025
B) 0.25
C) 2.5
D) 25
E) 250

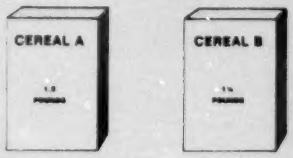
67. Curtains at least 6 feet 8 inches long are needed for a set of windows.

Which one of the following standard curtain lengths is closest to the length required?

A) 66 inches
B) 68 inches
C) 72 inches
D) 84 inches
E) 90 inches

68. Which of the following is true of the two boxes of cereal shown in the figure?

A) A weighs $\frac{1}{2}$ lb more than B.
B) A weighs $\frac{1}{5}$ lb more than B.
C) B weighs $\frac{1}{2}$ lb more than A.
D) B weighs $\frac{1}{5}$ lb more than A.
E) A and B weigh the same.



69. Which is the largest unit of measure?

A) milliliter
B) teaspoon
C) quart
D) liter
E) pint

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70. Mary has chosen paneling for one wall of her room. The wall is 8 feet high and 14 feet long. A sheet of paneling is 8 feet by 4 feet. How many sheets does she need to buy?

A) 2
B) 3
C) 4
D) 5
E) 8

71. A rectangular garden plot is 8 meters long and 7 meters wide. The area of the garden is ___?___ square meters.

A) 7
B) 8
C) 15
D) 30
E) 56

72. It takes 3 kilograms of sand to cover the icy sidewalk in front of the school. During the winter the icy sidewalk is covered with sand 10 times. How many kilograms of sand are left from a 50-kilogram bag?

A) 20
B) 30
C) 40
D) 50
E) 60

73. At what temperature does water begin to boil on the Fahrenheit scale?

A) 212°F
B) 180°F
C) 100°F
D) 32°F
E) 0°F

74. In the United States, we usually buy gasoline by the gallon. In France, where the metric system is used, people buy gasoline by the

A) meter.
B) liter.
C) quart.
D) gram.

75. In the United States, we usually by potatoes by the pound. In France, where the metric system is used, people buy potatoes by the

A) meter.
B) liter.
C) pound.
D) kilogram.

76. The number of centimeters in one meter is

A) $\frac{1}{100}$

B) 10

C) 100

D) 1000

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THE ILLINOIS INVENTORY OF EDUCATIONAL PROGRESS

1982 GRADE 11

MATHEMATICAL MEASUREMENT TEST

Directions (to be read aloud by the test administrator)

You will have 45 minutes to complete the mathematics test which begins with question 18 and ends with question 69. Work at a reasonably fast pace. You should be able to complete all the test questions. If you have extra time go back and check your work. If you finish before the test administrator tells you to stop, go on and complete questions 70-87. READY, BEGIN.

18. Estimate the following:

The height of your teacher's desk is approximately ___?___ centimeters.

A) 2
B) 7
C) 20
D) 70
E) 200

19. The area of this page is about ___?___ square decimeters.

A) 4
B) 6
C) 9
D) 600
E) 750

20. Ron's father is two meters tall. How many centimeters is that?

A) 200
B) 400
C) 600
D) 800
E) 1000

21. Mr. Johnson wants to buy carpeting for his living room. The room is square and has a perimeter of 56 feet. The area of the room is ___?___ square feet.

A) 144
B) 169
C) 182
D) 196

22. Curtains of six feet, seven inches long are needed for a set of windows. Which one of the following standard curtain lengths is closest to the length required?

A) 56 inches
B) 69 inches
C) 72 inches
D) 84 inches
E) 90 inches

23. Jane wants a bulletin board whose area is one square yard. How many cork tiles would she buy if each cork tile has an area of one square foot?

A) 3
B) 9
C) 10
D) 27
E) 144

24. Which of the following is the longest?

A) 0.077 meters
B) 7 decimeters, 6 centimeters
C) 77 centimeters, 16 millimeters
D) 78 centimeters
E) 770 millimeters

25. John's parents bought a refrigerator for $375. If they pay $20 per month for two years, how much more than $375 will the refrigerator cost them ?

A) $ 95
B) $105
C) $200
D) $375

26. A meter is closest to which of these?

A) An inch
B) A foot
C) A yard
D) A mile
E) A rod

27. If a carpet company sent a 3 meter by 4 meter rug to carpet a 9 foot by 12 foot room,

A) it will exactly fit.
B) if only the length is trimmed, it will exactly fit.
C) if only the width is trimmed, it will exactly fit.
D) if both the length and the width are trimmed, it will exactly fit.
E) it is too small to cover the floor.

28. What is the length of the key to the nearest quarter inch?

A) $1\frac{3}{4}$ inches
B) 2 inches
C) $2\frac{1}{4}$ inches
D) $2\frac{1}{2}$ inches
E) $3\frac{1}{2}$ inches

29. Television sets are on sale at two stores. One offers a 10 percent discount while the other offers 15 percent. What is the difference in dollars in the sale price at the two stores of a TV set that is regularly priced at $100?

A) $5
B) $10
C) $15
D) $25

30. The meter would be a good unit to use to measure the length of

A) a bridge over the Mississippi River.
B) a ladybug.
C) a man's foot.
D) the State of Illinois.
E) a piece of chalk.

31. Which is shortest?

A) 0.4 kilometers
B) 5 meters
C) 40 decimeters
D) 300 centimeters
E) 4000 millimeters

32. A piece of pipe is 456 centimeters long. Its length in meters is ___?___ meters.

A) .456
B) 4.56
C) 45.6
D) 4,560
E) 45,600

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33. Tom bought a bicyle last year for $70. This year the same model is selling for 10% more. What is the price of the bicyle this year?

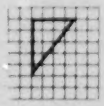
A) $77
B) $80
C) $82
D) $87

34. The width of a person's hand is closest to ___?___ centimeter(s).

A) 1
B) 10
C) 100
D) 1,000
E) 10,000

35. The area of the triangular figure is

A) 4 square units.
B) 6 square units.
C) 7 square units.
D) 8 square units.
E) 10 square units.



36. How many 10-inch pieces can be cut from a metal bar 2 yards, 8 inches long if one allows 0.2 inch for each saw cut?

A) 400
B) 70
C) 8
D) 7
E) 3

37. A door-to-door salesperson receives 20 percent of the retail value of his/her sales as commission. What must his/her total retail sales be if he/she is to earn a commission of $60?

A) $120
B) $200
C) $250
D) $300

38. The height of a dining room table is about 7.5

A) millimeters.
B) decimeters.
C) kilometers.
D) centimeters.
E) hectometers.

39. How long is the pencil to the nearest millimeter?

A) 57 millimeters
B) 65 millimeters
C) 7 millimeters
D) 6.7 millimeters
E) 6 millimeters

40. The solution set of the equation $x^2 = 9$ is

A) $\{3\}$
B) $\{-3\}$
C) $\{x=3\}$
D) $\{-3, 3\}$

41. The area of the face of a pocket watch would probably be measured in

A) square centimeters.
B) square decimeters.
C) square meters.
D) square millimeters.
E) square kilometers.

42. In order to conserve energy one can put weather strips around windows to prevent heat loss. If you have a 70 centimeter by 90 centimeter window, how long a piece of weather stripping must you purchase to go around that window?

A) 20 centimeters
B) 160 centimeters
C) 320 centimeters
D) 6300 centimeters
E) 7090 centimeters

43. Find the area of a circle if the circumference is 16.

A) 8π
B) $\frac{8}{\pi}$
C) 64
D) 64π
E) $\frac{64}{\pi}$

44. $(4x + 2)(x - 5) =$

A) $4x + 2 \times x - 5$
B) $4x^2 - 18x - 10$
C) $4x - 10$
D) $4x + 2x - 3$

45. 5,000 milliliters is equal to how many liters?

A) 0.5
B) 5
C) 500
D) 5,000
E) 50,000

46. 3 pounds is equal to ___?___ ounces?

A) 30
B) 36
C) 45
D) 48

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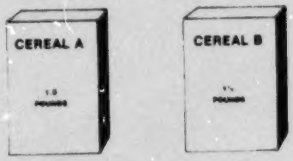
47. The approximate metric capacity of the carton is

A) 1 liter.
B) 2 liters.
C) 3 liters.
D) 100 milliliters.
E) 500 milliliters.

48. Which of the following is true of the two boxes of cereal shown in the figure?



A) A weighs 1/5 lb more than B.
B) A weighs 1/4 lb more than B.
C) B weighs 1/4 lb more than A.
D) B weighs 1/2 lb more than A.
E) A weighs 2 3/4 lb more than B.

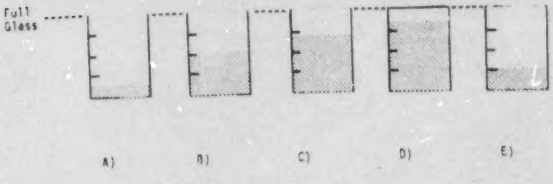
49. The gas tank of a full-sized American car has a volume of about 80

A) deciliters.
B) milliliters.
C) liters.
D) centiliters.
E) kiloliters.

50. Which unit would probably be used to give the weight of a pair of tennis shoes?

A) kilogram
B) kiloliter
C) milligram
D) millimeter
E) milliliter

51. A glass of milk is 8 ounces. Which drawing shows 2 ounces?



52. The weight of the package shown on the scale below is ___?___ kilograms.

A) 10.2
B) 12
C) 10.4
D) 14
E) 15

53. The volume of sand needed to fill a box 9 centimeters long, 3 centimeters wide, and 4 centimeters deep is ___?___ cubic centimeters.

A) 16
B) 108
C) 31
D) 27

54. Water weighs about 62.5 pounds per cubic foot. The weight of the water which fills a tank 5 feet by 4 feet by 1.4 feet is ___?___ pounds.

A) 175
B) 650
C) 1,750
D) 15,750
E) 17,500

55. A recipe calls for one liter of water. If Bob makes only half the recipe, how many milliliters of water will he need?

A) 0.5
B) 5
C) 50
D) 500
E) 5,000

56. What unit of mass would be used to sell wheat on the foreign market?

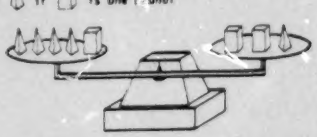
A) milligram
B) centigram
C) gram
D) kilogram
E) metric ton

57. A swimming pool 50 meters long and 25 meters wide is uniformly 2 meters deep. How many kiloliters of water does it hold?

A) 0.25
B) 2.5
C) 25
D) 250
E) 2,500

58. What is the weight of if is one pound?

A) $\frac{1}{2}$ pound
B) $\frac{1}{4}$ pound
C) 1 $\frac{1}{2}$ pounds
D) 2 pounds
E) 3 pounds



59. What temperature is shown on this thermometer?

A) -20°
B) 20°
C) -40°
D) 40°
E) -10^{0}

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60. Normal body temperature is __?__ degrees Celsius.

A) 0
B) 37
C) 40
D) 98.6
E) 100

61. 1400 meters is equal to __?__ kilometers.

A) 0.14
B) 1.4
C) 14
D) 140
E) 140,000

62. What is the temperature?

A) 10°
B) 10.2°
C) 12°
D) 14°
E) 16°

63. It would be reasonable to paint the outside of your house when the air temperature is __?__ degrees Celsius.

A) 100
B) 80
C) 70
D) 20
E) 0

64. Which is the heaviest?

A) 1 kilogram
B) 1 pound
C) 2 pounds
D) 31 ounces
E) 50 grams

65. To maintain a comfortable room temperature in the winter and not waste fuel, a Celsius thermostat should be set at __?__ degrees Celsius.

A) 78
B) 58
C) 40
D) 20
E) 10

66. Which is longest?

A) 1 yard
B) 3 yards
C) 10 meters
D) 10 feet
E) 100 centimeters

67. In the United States, we usually buy gasoline by the gallon. In France, where the metric system is used, people buy gasoline by the

A) meter.
B) liter.
C) quart.
D) gram.

68. In the United States, we usually buy potatoes by the pound. In France, where the metric system is used, people buy potatoes by the

A) meter.
B) liter.
C) pound.
D) kilogram.

69. Which is the CLOSEST to the size of one square centimeter?

A) A tennis court
B) Your thumbnail
C) A slice of bread
D) The cover of a record album

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APPENDIX B

Answer Keys, Student Scores, and Teacher Survey Results

Fourth Grade Test

Statewide Summary Data for the Total Test

Statewide Mean of Student % Correct	Mean of Teacher Estimates for % Correct	Mean Level of Opportunity to Learn (1-none, 9-heavy)	Mean Difficulty Level (1-easy, 9-difficult)
47%	47%	4.20	5.43

4th Grade
Item-by-Item Data

Item #	Correct Answer	Student % Correct	Teacher Est. % Correct	Level of Student Exp. (1-none 9-heavy)	Difficulty of the Item (1 easy, 9-difficult)
18	D	39%	44%	4.10	5.51
19	B	24%	30%	2.97	7.04
20	A	49%	33%	3.10	6.73
21	C	71%	76%	8.64	3.70
22	A	56%	53%	4.61	4.57
23	E	37%	41%	3.95	5.51
24	D	40%	39%	3.87	5.62
25	D	75%	85%	8.45	2.19
26	D	39%	59%	5.30	3.57
27	B	32%	28%	3.07	6.97
28	B	63%	54%	3.90	4.98
29	B	68%	78%	7.25	2.77
30	C	43%	54%	5.23	5.35
31	C	64%	49%	3.98	5.54
32	C	37%	46%	4.29	5.11
33	C	68%	48%	3.52	4.91
34	C	49%	37%	3.67	6.51
35	E	66%	65%	5.61	4.02
36	C	45%	57%	5.16	4.58
37	B	56%	55%	3.96	5.08
38	D	34%	41%	3.93	6.12
39	B	41%	24%	2.38	7.57
40	A	47%	48%	3.76	5.25
41	C	45%	48%	5.36	5.68
42	D	45%	58%	6.20	4.95
43	E	72%	50%	3.30	5.18
44	E	34%	44%	4.02	5.89
45	D	30%	59%	4.03	4.29
46	B	26%	34%	2.96	6.96
47	E	37%	32%	2.78	6.91
48	C	75%	58%	4.22	4.63
49	D	43%	44%	3.34	5.69
50	B	42%	37%	3.20	6.32
51	E	22%	33%	2.97	6.35
52	A	28%	39%	2.91	5.95
53	C	29%	31%	2.78	6.98
54	D	35%	35%	3.17	6.76
55	C	30%	35%	3.12	6.09
56	B	48%	59%	4.59	4.48
57	D	54%	58%	5.02	4.86
58	C	37%	51%	3.64	5.20
59	C	60%	59%	4.44	4.43
60	D	43%	43%	3.51	5.20
61	C	23%	26%	2.38	6.88

Eighth Grade Test

State Summary Data for the Total Test

Statewide Mean of Student % Correct	Mean of Teacher Estimates for % Correct	Mean Level of Opportunity to Learn (1-none, 9-heavy)	Mean Difficulty Level (1-easy, 9-difficult)
48%	57%	5.53	4.64

Item-by-Item Data

Item #	Correct Answer	Student % Correct	Teacher Est. % Correct	Level of Student Exp. (1-none 9-heavy)	Difficulty of the Item (1 easy, 9-difficult)
18	B	38%	63%	5.18	3.76
19	B	24%	39%	3.27	6.07
20	E	24%	57%	5.39	4.51
21	B	59%	70%	6.54	3.43
22	C	37%	54%	5.16	4.88
23	D	41%	56%	5.75	4.71
24	D	73%	76%	6.37	2.67
25	D	80%	75%	7.52	3.73
26	E	10%	41%	4.63	6.07
27	B	35%	50%	5.41	5.31
28	D	43%	56%	5.46	4.60
29	B	78%	63%	6.13	4.04
30	C	26%	55%	5.36	4.84
31	B	36%	34%	3.99	6.71
32	E	36%	41%	4.72	6.01
33	D	56%	65%	6.79	4.37
34	C	32%	66%	5.58	3.82
35	B	61%	61%	4.80	4.16
36	C	68%	55%	5.22	4.65
37	B	58%	61%	6.59	4.90
38	D	67%	68%	5.82	3.86
39	A	72%	56%	4.33	4.26
40	B	57%	60%	5.77	4.40
41	B	49%	57%	6.10	5.36
42	B	66%	53%	4.63	4.97
43	D	32%	38%	4.08	6.29
44	C	66%	65%	6.22	4.05
45	C	44%	56%	5.76	4.42
46	D	23%	55%	5.82	4.97
47	E	26%	49%	5.20	5.25
48	A	41%	49%	5.32	5.17
49	A	37%	36%	4.21	6.44
50	B	46%	48%	4.94	5.46
51	E	51%	66%	5.22	3.84
52	C	31%	54%	5.12	4.76
53	C	48%	61%	5.49	4.45
54	D	35%	65%	5.48	3.72
55	D	57%	64%	5.48	4.03
56	D	63%	63%	5.10	3.98
57	C	42%	34%	3.77	6.24
58	D	40%	69%	6.30	3.76
59	D	38%	33%	3.63	6.81
60	C	28%	42%	5.14	5.93
61	C	82%	73%	5.48	3.35
62	B	38%	69%	5.48	3.39
63	A	83%	64%	5.16	3.72
64	E	50%	70%	5.17	3.23
65	C	29%	47%	4.74	5.59
66	E	18%	44%	4.73	5.63
67	D	41%	55%	5.27	4.57
68	A	44%	54%	5.58	4.96
69	D	38%	46%	4.24	5.20
70	C	35%	47%	4.90	5.59
71	E	54%	67%	6.44	3.82
72	A	62%	61%	6.16	4.48
73	A	39%	62%	5.21	3.85
74	B	66%	[illegible]%	5.61	3.57
75	D	66%	63%	5.42	3.67
76	C	47%	68%	6.27	3.45

Eleventh Grade Test

State Summary Data for the Total Test

Statewide Mean of Student % Correct	Mean of Teacher Estimates for % Correct	Mean Level of Opportunity to Learn (1-none, 9-heavy)	Mean Difficulty Level (1-easy, 9-difficult)
54%	58%	5.48	3.41

Item-by-Item Data

Item #	Correct Answer	Student % Correct	Teacher Est. % Correct	Level of Student Exp. (1-none 9-heavy)	Difficulty of the Item (1 easy, 9-difficult)
18	D	52%	51%	4.72	3.03
19	B	20%	36%	3.84	4.68
20	A	66%	64%	5.45	2.52
21	D	34%	57%	6.41	4.17
22	D	54%	71%	6.68	2.59
23	B	46%	62%	6.22	3.40
24	C	27%	45%	4.75	4.32
25	B	73%	70%	6.65	3.03
26	C	75%	78%	6.38	1.89
27	D	44%	49%	4.82	4.47
28	C	68%	74%	6.56	2.32
29	A	76%	63%	6.35	3.59
30	A	53%	63%	5.43	3.05
31	D	38%	49%	5.07	4.10
32	B	58%	60%	5.65	3.04
33	A	63%	66%	6.42	3.28
34	B	74%	59%	5.29	3.12
35	E	37%	61%	6.37	3.66
36	D	37%	47%	5.18	4.96
37	D	51%	47%	5.75	4.96
38	B	55%	50%	4.93	3.53
39	B	73%	67%	5.66	2.60
40	D	34%	61%	6.40	3.61
41	A	51%	47%	4.52	4.03
42	C	50%	63%	6.07	3.06
43	D	19%	45%	5.82	4.97
44	B	49%	53%	6.35	4.44
45	B	60%	52%	5.09	3.29
46	D	63%	67%	6.10	2.42
47	A	58%	58%	5.29	2.96
48	B	67%	64%	6.15	3.24
49	C	59%	46%	4.38	4.19
50	A	51%	53%	4.78	3.38
51	E	65%	75%	6.15	2.15
52	D	33%	75%	5.96	2.20
53	B	64%	63%	5.88	3.29
54	C	35%	46%	5.44	4.98
55	D	38%	52%	5.25	3.51
56	E	39%	50%	4.22	3.53
57	E	36%	36%	4.23	5.18
58	B	59%	44%	4.46	4.99
59	C	64%	78%	6.33	1.96
60	B	31%	54%	4.94	3.27
61	B	40%	59%	5.52	2.85
62	D	63%	81%	6.42	1.77
63	D	43%	51%	4.73	3.55
64	A	30%	47%	4.70	3.88
65	D	33%	48%	4.65	3.74
66	C	68%	59%	5.24	3.08
67	B	85%	71%	5.55	2.25
68	D	70%	68%	5.37	2.48
69	B	76%	63%	5.22	2.75

APPENDIX C

ILLINOIS STATE BOARD OF EDUCATION
Department of Planning, Research and Evaluation
Program Evaluation and Assessment Section
100 North First Street
Springfield, Illinois 62777

(1) (2) (3)

4th GRADE 1982 MATH ATTENDANCE CENTER TEACHER SURVEY

INSTRUCTIONS: Starting with Column 1, indicate your response by placing a number corresponding to your opinion in the appropriate box. Return the form to your building principal when completed.

ITEM NUMBER	On a scale of 1 to 9 (1 - No Student Exposure; 9 - Heavy Student Exposure), TO WHAT EXTENT HAVE STUDENTS BEEN EXPOSED TO THE ITEM CONTENT? 1-9	On a scale of 1 to 9 (1 - Not at All; 9 - Very Well), HOW WELL DOES THE ITEM MEASURE THE CONTENT BEING TAUGHT IN 4th GRADE? 1-9	On a scale of 1 to 9 (1 - Very Easy; 9 - Very Difficult) INDICATE THE DIFFICULTY OF THE ITEM. 1-9	WHAT PERCENTAGE OF STUDENTS WILL ANSWER THIS ITEM CORRECTLY ___%
18				
19				
20				
21				
22				
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41				

ITEM NUMBER	On a scale of 1 to 9 (1 - No Student Exposure; 9 - Heavy Student Exposure), TO WHAT EXTENT HAVE STUDENTS BEEN EXPOSED TO THE ITEM CONTENT? 1-9	On a scale of 1 to 9 (1 - Not at All 9 - Very Well). HOW WELL DOES THE ITEM MEASURE THE CONTENT BEING TAUGHT IN 4th GRADE? 1-9	On a scale of 1 to 9 (1 - Very Easy; 9 - Very Difficult) INDICATE THE DIFFICULTY OF THE ITEM. 1-9	WHAT PERCENTAGE OF STUDENTS WILL ANSWER THIS ITEM CORRECTLY ___%
42				
43				
44				
45				
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ISBE 41-10 (12/81)

APPENDIX D

Description of Factor Analysis

Factor analysis is a highly technical mathematical and statistical procedure which cannot be fully explained here. However, an intuitive understanding of factors and their derivation is possible. Fred Kerlinger, in his book Foundations of Behavioral Research (1973) wrote:

> Factor analysis is a method for determining the number and nature of the underlying variables among large numbers of measures.
>
> Generally speaking, if two tests measure the same thing, the scores obtained from them can be added together. If, on the other hand, the two tests do not measure the same thing, their scores cannot be added together. Factor analysis tells us, in effect, what tests or measures can be added and studied together, rather than separately. It thus limits the variables with which the scientist must cope. It also (it is hoped) helps the scientist to locate and identify unities or fundamental properties underlying tests and measures.
>
> A factor is a construct, a hypothetical entity that is assumed to underlie tests and test performance. A number of factors have been found to underlie intelligence, for example: verbal ability, numerical ability, abstract reasoning, spatial reasoning, and memory.

A Hypothetical Example

Suppose we administer six tests to a large number of seventh grade pupils. We suspect that the six tests are not measuring six, but some smaller number of variables. The tests are: vocabulary, reading, synonyms, numbers, arithmetic (standardized tests), and arithmetic (teacher-made tests). The names of these tests indicate their nature. We label them respectively, V, R, S, N, AS, AT. (The last two tests, though both arithmetic, have different contents and reliabilities. We assume a good reason for including them both in a test battery.) After the tests are administered and scored, coefficients of correlation are computed between each test and every other test. We lay out the r's in a correlation matrix (usually called R matrix). The matrix is given in Table 37.1 (Table 23).

Table 23

TABLE 37.1 R MATRIX: COEFFICIENTS OF CORRELATION AMONG SIX TESTS

		V	R	S	N	AS	AT
	V		.72	.63	.09	.09	.00
Cluster I	R	.72		.57	.15	.16	.09
	S	.63	.57		.14	.15	.09
	N	.09	.15	.14		.57	.63
	AS	.09	.16	.15	.57		.72
	AT	.00	.09	.09	.63	.72	

Cluster II

...How many underlying variables or factors are there?...The factors are presumed to be underlying unities between the test performances. They are reflected in the correlation coefficients. If two or more tests are substantially correlated, then the tests share variance. They have common factor variance. They are measuring something in common.

...There are two factors. This is indicated by the clusters of r's circled and labeled I and II in Table 37.1. Note that V correlates with R,.72; V with S,.63; and R with S,.57. V, R, and S appear to be measuring something in common. It is important to note, however, that the tests in Cluster I, though themselves intercorrelated, are not to any great extent correlated with the tests in Cluster II. Likewise, N, AS, and AT, though themselves intercorrelated, are not substantially correlated with the tests V, R, and S. What is measured in common by the tests in Cluster I is evidently not the same as what is measured in common by the tests in Cluster II. There appear to be two clusters or factors in the matrix.

For further discussion of factor anaylsis, see Kerlinger (1973, pp. 659-692) and cited references.

APPENDIX E

Mathematical Measurement Committee

Lynn H. Brown
Illinois State University

John A. Dossey
Illinois State University

Dale G. Jungst
Northern Illinois University

Kenneth A. Retzer
Illinois State University

Mervin M. Brennan
Illinois State Board of Education

Wendell A. Meeks
Illinois State Board of Education

APPENDIX F

Partial Listing of Documents Available from the
Program Evaluation and Assessment Section
Illinois State Board of Education
November, 1982

The following is a listing of recent publications available from the Program Evaluation and Assessment Section. Only those publications for which copies are available for distribution are included on the list. Supplies are limited. In order to receive one copy of a publication, contact the person listed below the document title. The address and phone number are:

Illinois State Board of Education
Program Evaluation and Assessment Section (S-284)
100 North First Street
Springfield, IL 62777
(217)782-4823

The documents are listed in chronological order by date of publication.

Standards and Criteria for the Selection of Educational Tests (1978)
Leslie J. Fyans, Jr.
15 pages

Adapted from 1974 American Psychological Association, American Educational Research Association, and National Council for Measurement in Education publication entitled Standards for Educational and Psychological Tests. That manual presents comprehensive guidelines for selecting instruments to measure educational growth, achievement, and outcomes and includes a subset of characteristics absolutely necessary for a test to be considered acceptable. The adapted publication presents the essential characteristics in a declarative sentence checklist format useful to district personnel in determining the acceptability of test instruments for local use.

1978 Reading Item Results
Illinois Inventory of Educational Progress (March, 1980)
Carmen Woods Chapman
200 pages

Presents 1978 IIEP reading results and professional comments on the results. Includes purpose and goals of the statewide assessment program, reading objectives, student sampling model, reporting variables, and how to interpret the results.

Tests Appropriate for Model A-1 in Illinois (March, 1980)
Rose O. Maye
102 pages

Presents descriptive information concerning all nationally normed standardized achievement tests appropriate for use with Model A-1, the norm-referenced model, used in evaluation of Illinois Title I programs in reading, language arts, and mathematics. Detailed information

concerning each test includes whether the test has an expanded standard score, the name given by the publisher for the expanded scale score, and whether out-of-level norms are available.

Conference Report: Minimum Competency Testing and Handicapped Students (April, 1980)
C. Thomas Kerins

59 pages

Presents an overview of legal, programmatic, and technical issues related to the application of minimum competency testing (MCT) to handicapped students. Based on proceedings from the State Board of Education MCT/Special Education Conference held January 3-4, 1980 in Chicago.

A Synopsis: What Statewide or Local Efforts Can Assure the Public That Students Are Appropriately Educated? (May, 1980)
Norman Stenzel
26 pages

State education agency staff conducted a series of surveys to determine what a select panel of educators felt could be done on a statewide or local basis to assure the public that students are appropriately educated. Description of the methodology, copies of actual instrumentation, and results obtained are included in the synopsis.

A Survey: What Statewide or Local Efforts Can Assure the Public That Students Are Appropriately Educated? (May, 1980)
Norman Stenzel
66 pages

State education agency staff conducted a series of surveys to determine what a select panel of educators felt could be done on a statewide or local basis to assure the public that students are appropriately educated. Description of the methodology, copies of actual instrumentation, and results obtained are included in the survey report.

Citizenship Curricular Analyses and Teacher Expectation Results Illinois Inventory of Educational Progress (June, 1980)
Ken Redding
27 pages

Presents curricular analyses by external reviewers of 1978 IIEP citizenship results and results on the teacher expectation survey conducted when the test was administered. The purpose of the teacher survey was to determine for each item on the citizenship test if students had been exposed to the content being assessed, if the item was of appropriate difficulty level, and teacher expectations of the percentage of students who would answer each item correctly. Includes purpose and goals of the statewide assessment program; citizenship objectives; student sampling model; analysis of results for each of grade levels four, eight, and eleven; and results for specific objectives.

Annual Report on Title I, ESEA Migrant Program, Fiscal Year 1980 (March, 1981)
Brenda Pessin
115 pages

Presents a summary of significant findings and comments by the evaluator, an overview of the migrant education program, descriptions of and findings relevant to several special Illinois migrant projects, and site visitation summaries based on interviews and observations at nine local migrant projects in Illinois.

1980 Nutrition Report
Illinois Inventory of Educational Progress (April, 1981)
Carmen Woods Chapman
27 pages

Describes the goals and objectives of the Illinois Nutrition Education and Training program and the Illinois Inventory of Educational Progress (IIEP). Outlines procedures used in developing the nutrition knowledge items and presents an analysis of results obtained from fourth, eighth, and eleventh grade students throughout the state.

Policy Checklist: How Would You Rate Your District with Respect to the Illinois State Board of Education Policy for Assessment and Student Achievement? (April, 1981)
Carmen Woods Chapman
1 page

Includes twelve questions answered "yes" or "no" to indicate the extent to which district policy and procedures reflect state education agency recommendations concerning how to assess student knowledge/ability and determine promotion/graduation status of students. Presents forty-three additional questions to guide discussion of district policy at the local level.

Checklist: Qualitative Review of Evaluations (April, 1981)
Norman Stenzel
1 page

Includes thirteen questions answered "yes" or "no" to indicate qualitative strengths or weaknesses of an evaluation. The questions concern the following seven components of an evaluation and rationale or explanation concerning each component: plan, audience, focus, management, data collection, analysis, and report.

Transitional Bilingual Education in Illinois: 1979-1980 Program Summary and Evaluation Report (May, 1981)
Connie J. Wise
168 pages

First annual evaluation report. Includes findings from data collected on students enrolled in Chicago and downstate transitional bilingual education programs in Illinois. Contents of the report can be used by local, state, and federal agencies in making fiscal and programmatic decisions. Target audiences include personnel of districts serving limited-English proficient students (regardless of whether or not the

district has a state-approved bilingual education program), institutions of higher education, and other agencies, as well as parent and community groups and legislators.

1979 Energy Assessment Report
Illinois Inventory of Educational Progress (June, 1981)
Norman Stenzel
39 pages

The 1979 administration of the Illinois Inventory of Educational Progress (IIEP) for grades four, eight, and eleven included questions on four energy-related topics: types and nature of energy, uses of energy, consequences of energy utilization, and conservation of energy. This document reports the results on the energy-related knowledge items administered at each of the three grade levels, as well as on nine attitude items administered at the eighth and eleventh grade levels. In addition, background information concerning the status of energy education in the schools based on principal- and teacher-written responses is presented.

Individualized Education Program Self-Audit (November, 1981)
Nancy Spinner
26 pages

Presents a self-audit package developed and tested using 16 sites and over 1,000 IEPs in Illinois. When used by providers of special education services, information concerning the quality of special education and related services will be obtained. Results from IEP self-audits will not only indicate the extent to which requirements of Public Law 94-142 are being met, but will provide useful data for improving IEP implementation and demonstrating responsible and accountable management.

1979 Mathematics Results for Fourth Grade Illinois Inventory of Educational Progress (November, 1981)
Mervin M. Brennan
29 pages

Describes development of the 1979 fourth grade IIEP mathematics test and presents fourth grade item results and analyses. Information provided should be useful in enhancing mathematics instruction in Illinois schools. Includes separate indexes of fourth grade mathematics objectives and items for the 1979 IIEP, a copy of the Fourth Grade 1979 Mathematics Attendance Center Teacher Survey, a list of the mathematics panel members, and a list of publications describing 1979 IIEP results for grades four, eight, and eleven on mathematics and energy-related questions.

1979 Mathematics Results for Eighth Grade Illinois Inventory of Educational Progress (November, 1981)
Mervin M. Brennan
36 pages

Describes development of the 1979 eighth grade IIEP mathematics test and presents eighth grade item results and analyses. Information provided should be useful to enhance mathematics instruction in Illinois schools. Includes separate indexes of eighth grade mathematics objectives and items for the 1979 IIEP, a copy of the Eighth Grade 1979 Mathematics Attendance Center Teacher Survey, a list of the mathematics panel members, and a list of publications describing 1979 IIEP results for grades four, eight, and eleven on mathematics and energy-related questions.

1979 Mathematics Results for Eleventh Grade Illinois Inventory of Educational Progress (November, 1981)
Mervin M. Brennan
34 pages

Describes development of the 1979 eleventh grade IIEP mathematics test and presents eleventh grade item results and analyses. Information provided should be useful to enhance mathematics instruction in Illinois schools. Includes separate indexes of eleventh grade mathematics objectives and items for the 1979 IIEP, a copy of the Eleventh Grade 1979 Mathematics Attendance Center Teacher Survey, a list of the mathematics panel members, and a list of publications describing 1979 IIEP results for grades four, eight, and eleven on mathematics and energy-related questions.

FY 81 Annual Report on Title I, Public Law 89-313 (January, 1982)
Connie J. Wise
78 pages

Publication prepared annually in order to comply with Federal Rules and Regulations for Title I programs and to provide descriptive and evaluative information concerning programs in the state. Based on data submitted on end-of-year self-assessment questionnaires by personnel of all fiscal year 1981 Illinois P.L. 89-313 funded projects.

Testing and Evaluation Reference (January, 1982)
Rose O. Maye
10 pages

A concise handbook for teachers and administrators of Title I, P.L. 89-10 programs. Includes: (1) definitions of commonly used testing terms; (2) purposes of district needs assessments (including kinds of data to include and ways to organize the data); (3) selection of students for Title I; (4) figuring of NCE gains; (5) interpretation of NCEs; (6) study of sustained effects; (7) evaluation of programs for which Model A-1 is not appropriate; and (8) elements of a good evaluation report.

Evaluation and Assessment (February, 1982)
Carmen Woods Chapman
6 pages

Provides a true-false quiz concerning State Board and local district policies on evaluation and student assessment, as well as descriptions of successful evaluation programs being used in six local districts in

Illinois. The programs are more completely described in a report entitled "Local School District Approaches to Assessment and Evaluation."

IIEP Reading Report: Results of the 1979 and 1980 Illinois Inventory of Educational Progress (March, 1982)
Carmen Woods Chapman
91 pages

Provides an overview of the 1979 and 1980 Illinois Inventory of Educational Progress (IIEP) for fourth, eighth, and eleventh grade reading. Results for each grade level and comparisons in performance between years and among topic areas are presented. Information presented can be used in developing curricula and improving instruction for Illinois schools.

Local School District Approaches to Assessment and Evaluation (May, 1982)
Carmen Woods Chapman
199 pages

The State Board Advisory Policy on Evaluation and Assessment (adopted in June, 1980) encourages districts to develop and implement a total student assessment and evaluation program. Descriptions of programs being used in six Illinois districts are presented as examples of various approaches being used successfully throughout the state.

Child-Find Self-Audit (June, 1982)
Michael Plog
37 pages

Presents self-audit package useful to administrators of local education agencies for collecting and interpreting information about local child-find activities. Information gathered using the package pertains to only the three- to five-year-old unserved (not underserved) population. Package is intended for local use only. Results are not to be reported to the Illinois State Board of Education. Depending on local circumstances and needs, any one or more of the techniques presented for measuring the effectiveness of child-find programs can be utilized. Purpose of the package is to describe methods to measure the effectiveness of child-find activities, not to measure compliance with state or federal laws or regulations.

Bilingual Education Mandate: A Preliminary Report (June, 1982)
Connie J. Wise
46 pages

One of five reports prepared by Illinois State Board of Education staff concerning mandates placed on elementary and secondary education in Illinois. Includes discussion of the mandate for transitional bilingual education in terms of the study methodology, a description of the current mandate and a historical perspective of the legislation, analyses of the study questions, findings and conclusions, and preliminary recommendations for action by the State Board of Education.

Handbook for Evaluation of Special Education Effectiveness (July, 1982)
Michael Plog
99 pages

Presents information about nine separate techniques, as well as sample worksheets and other information, that can be used by local practitioners in evaluating their own special education programs. The handbook was designed for use by school administrators who are contracting with an evaluation consultant or conducting evaluation of a local program and is not intended to be a comprehensive textbook on evaluation. The handbook was prepared for use by special education practitioners, but contains information relevant to other users.

The Use, Relevance, and Appropriateness of Tests for Educational Decision Making (September, 1982)
Leslie J. Fyans, Jr.
124 pages

The use, relevance, and appropriateness of tests for educational decision making at the local level were studied in terms of the quality of teacher judgment concerning test development and implementation, utility of test information to teachers, and factors affecting student test performance. Data were obtained from fourth and eighth grade teachers and their students and ninth and eleventh grade teachers, all from Springfield School District #186. All participants responded to paper-and-pencil instruments. The ninth grade teachers were also interviewed by research assistants.

Student Achievement in Illinois: An Analysis of Student Progress (December, 1982)
C. Thomas Kerins
81 pages

Describes and synthesizes the results of six different measures of achievement of Illinois students. The tests are the Illinois Inventory of Educational Progress (IIEP), Decade Study Test (DST), High School and Beyond test (HSB), Scholastic Aptitude Test (SAT), American College Test (ACT), and National Assessment of Educational Progress (NAEP). The report provides an analysis of student progress across years, from basic to advanced skills in reading, language arts, social studies, mathematics and science. The study of student achievement was conducted to answer three major questions: How well are Illinois students performing in academic areas as compared to students in other parts of the nation and the nation as a whole? How well are Illinois students of today performing in academic areas as compared to Illinois students during the last decade? What student and school characteristics are related to achievement of Illinois students?

Illinois Inventory of Educational Progress Test Booklets
Doris Slagle

Fourth Grade Test Booklets
1978: Mathematics, Reading, and Citizenship
1979: Mathematics, Reading, and Energy
1980: Mathematics, Reading, and Nutrition
1981: Mathematics, Reading, and Science
1982: Mathematical Measurement and Reading
1983: Mathematics, Reading, Language Arts, and Writing

Eighth Grade Test Booklets
1978: Mathematics, Reading, and Citizenship
1979: Mathematics, Reading, and Energy
1980: Mathematics, Reading, and Nutrition
1981: Mathematics, Reading, and Science
1982: Mathematical Measurement and Reading
1983: Mathematics, Reading, Language Arts, and Writing

Eleventh Grade Test Booklets
1978: Mathematics, Reading, and Citizenship
1979: Mathematics, Reading, and Energy
1980: Mathematics, Reading, and Nutrition
1981: Mathematics, Reading, and Science
1982: Mathematical Measurement and Reading
1983: Mathematics, Reading, Language Arts, and Writing

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PUBLICATION TITLE: **Summary of the 1982 Mathematics Results of the Illinois Inventory of Educational Progress**

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2. HOW USEFUL DID YOU FIND THIS PUBLICATION? ☐ Very Useful ☐ Somewhat Useful ☐ Not Useful

3. WAS THE FORMAT SUITABLE FOR THE CONTENT? ☐ Yes ☐ No

4. WAS THE MATERIAL COVERED SUFFICIENTLY? ☐ Yes ☐ No

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SUGGESTIONS FOR IMPROVEMENT

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